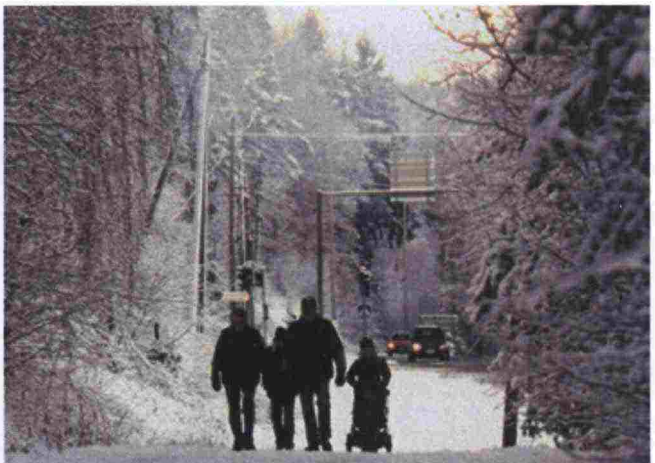

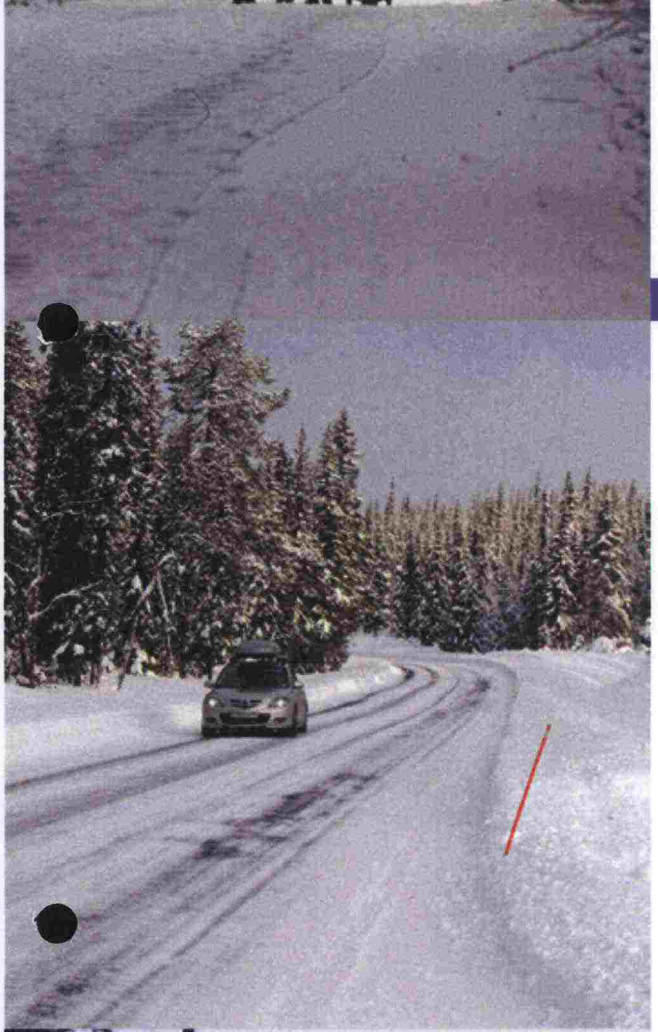

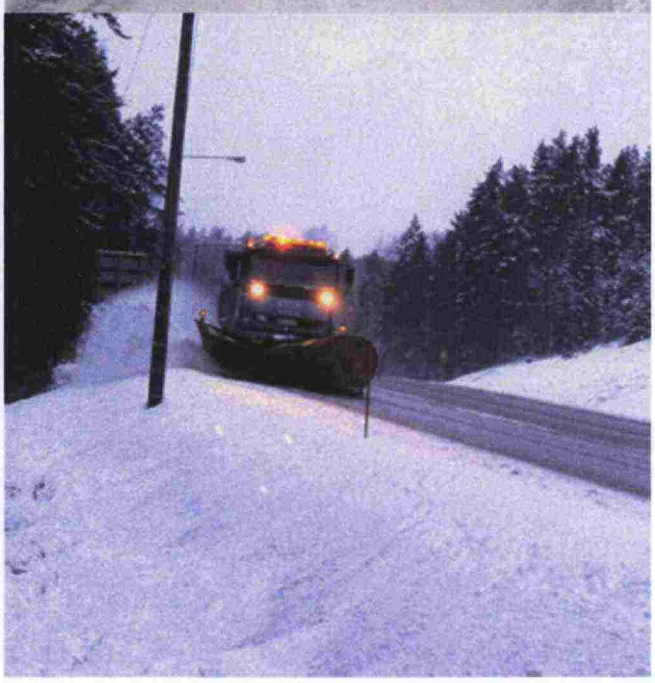

Winter Maintenance Policy

TIEHALLINTO
FINNISH ROAD ADMINISTRATION

Winter Maintenance Policy

Finnish Road Administration
Helsinki 2008

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Finnish Road Administration
Central administration
Opastinsilta 12A
PL 33
00521 HELSINKI
Telephone 0204 22 11

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SUMMARY

The objective of the road maintenance authority is to provide road conditions for traffic which ensure that movement and transports can be handled effectively and safely during the winter. Nevertheless, winter traffic requires road users to prepare for demanding conditions and they must exercise greater care and judgement than normally, especially in changeable weather conditions. Road users will be notified of such situations, so that they can take them into account when planning their trips and transports.

The operational service level for winter traffic is planned on the basis of the volume of traffic on the road, the road class, the nature of the traffic and the climate zone, taking into consideration the key needs of customers. The road's maintenance service class and the quality requirements that describe its quality level are determined on the basis of these factors. The objective is to ensure consistent maintenance quality requirements across areas providing traffic connections. Furthermore, there should be no surprising quality differences on the borders between highways and roads maintained by cities. The quality level is defined so that traffic conditions are good on the busiest part of the road network and adequate on the low-traffic part of the road network. The quality level is planned cost-effectively.

On nationally important main roads with high traffic volumes, which also form the trunk routes for heavy transports, the basic road conditions are bare roads or antiskid conditions. Antiskid treatment is implemented through proactive measures. On very busy roads it is ensured that slippery conditions will not cause problems, with the exception of the most problematic situations resulting from rain. In normal winter conditions, the weather allows scheduled traffic to be managed along the connections in question at speeds in accordance with the speed limits in force during the winter. The operational preconditions for public transport are supported through targeted winter maintenance. Environmental harm is kept under control in groundwater areas.

Following the end of exceptionally heavy snowfall, roads are returned to normal conditions as fast as possible using the equipment available and in accordance with the rules on rest periods. Road users and personnel carrying out transports must be prepared for delays under exceptional weather conditions.

Other national main roads are maintained so that the basic road conditions are antiskid winter conditions. Even under normal winter conditions, roads will sometimes be slippery and road users must limit their driving speed to that required by the situation. Due to climate change, the expansion of winter and night-time speed limits is being considered.

High-traffic regional and connecting roads are maintained so that the basic road conditions are moderate winter road conditions. Even under normal winter conditions, roads will be slippery, so road users and transports must be prepared for occasional delays. On other regional and connecting roads, the basic road conditions are tolerable winter conditions. Delays are common. It is possible to drive safely on the road by slowing down, and driving speeds must be reduced significantly during difficult road conditions.

Winter road maintenance is successful when the actual quality corresponds to the ordered quality. This requires a sufficiently efficient and well-designed quality assurance system.

PREFACE

The winter maintenance policy describe the principles and policies according to which highways are maintained in the winter, and the traffic-worthiness of roads is ensured during wintertime. The policy defines the level of service for the road network during winter-time and the quality requirements that are necessary to describe it. The winter maintenance policy also describes the key objectives, decisions and customer needs behind the policy and which affect the policy. The policy covers all of Finland, but it is applied in different parts of the country based on the regional and local needs and conditions. This policy replaces the earlier policy adopted in 2001.

The research approach to winter maintenance and its effects has not materially changed since the introduction of the earlier policy. The conception of traffic safety, environmental effects, winter-time traffic and especially the needs of customers has sharpened further. Numerous background analyses were carried out in connection with the preparation work, as well as active dialogue with customers and other stakeholder groups.

Separate, more precise quality requirements have been prepared on the basis of this policy; they function as quality requirements for winter maintenance contracts.

The winter maintenance policy has been prepared by an internal working group at the Finnish Road Administration with the following members: Olli Penttinen, Tuovi Päiviö-Leppänen, Auli Forsberg, Jorma Helin, Leo Koivula, Heikki Lappalainen, Anne Leppänen, Timo Mäkikyrö, Pasi Pirtala and Saara Toivonen. Background work on the policy was carried out by Mikko Malmivuo, Riikka Rajamäki and Kyösti Laukkanen from VTT Technical Research Centre of Finland.

Helsinki, 2008

The Finnish Road Administration
Expert Services

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1 INTRODUCTION

The winter maintenance policy defines the operational level of service for the road network with respect to winter road conditions and traffic. The winter maintenance of the whole road network is based on this policy and the principles presented in it. The policy is applied in different parts of the country according to the local conditions and traffic needs. The objective is to achieve a consistent level of quality throughout the road network, which means that the parts of the road network in different parts of Finland that are similar provide the same possibilities for movement.

The key quality requirements presented in the policy are specified in more detail in separate quality requirements. Local precision maintenance sites are recorded as project-specific specifications to the maintenance contract. Quality requirements and project-specific specifications function as quality assessments of the contractor's work. Winter maintenance is to a great extent a service operation that is tied to the prevailing weather conditions, and cannot be described through quality requirements in all respects. It is important that practical operations follow good principles and contractors strive to achieve the objectives presented in the winter maintenance policy in a customer-oriented fashion. In addition, it is important that the orderer monitors the implementation of the quality requirements. When practical work is carried out in rapidly changing weather conditions and on the basis of forecasts, it is important that the road maintenance authority can rely on the contractor that is responsible for the project, and that the contractor knows the objectives, operating principles and methods of winter maintenance. The contractor presents these in its quality plan.

The total length of the road network is approximately 78,000 kilometres. Unimportant public roads are converted into private roads in accordance with a procedure agreed separately with the Ministry of Transport and Communications. Traffic is assumed to increase at an annual rate of just under 2%, although the rate of growth is forecast to slow gradually starting in the 2010s. Traffic is increasing throughout Finland, with the strongest growth on highways, main roads and regional roads. The change in an individual link of the road network may, however, differ significantly from the average rate of change.

Winter maintenance has a major impact on the functionality of the entire traffic system. The vehicle mileage during the winter half of the year (6 months) is approximately 45% of the mileage during the entire year. In many sectors of the economy, the share of transports during the winter months is greater than during the summer time. Society and the economy depend on transports and road traffic and expect traffic to function equally reliably during all seasons and times of the day.

Winter maintenance traffic policies are based upon the premise that most cars use studded tyres. The development of car vehicle technology and tyre quality are expected to reduce the risks resulting from winter weather. Climate warming and the resulting increase in unusual weather phenomena pose a significant new challenge for winter maintenance. This policy is based upon the present traffic regulations concerning winter tyres, for example, and especially studded tyres. The policy also starts from the assumption that the use of salt in antiskid treatment will continue to be possible.

2 WINTER MAINTENANCE AND WINTER TRAFFIC

The objective of road maintenance is also to provide the possibility for functioning and safe transports and movement during the winter season throughout Finland and during all times of the day. In addition to winter and ice, traffic is affected by darkness, wetness and the resulting reduced visibility. Climate change is increasing extreme variations in weather and has brought new challenges, such as frost heave problems in the winter, rain during wintertime further to the north and exceptionally severe snowfall.

In addition to the actual winter maintenance, successful management of winter traffic requires that the road network is in good basic condition: The effects of incorrect cambers, holes in the paving, or deep worn grooves, for example, on traffic are reinforced on slippery roads and roads with patches of hard-packed snow. Good visibility of traffic control signs and equipment, especially road markings and marker posts, is necessary, especially in poor road conditions.

2.1 Background guidelines

The following documents and decisions form the background to the planning of the winter maintenance policy:

Liikennepolitiikan linjat ja liikenneverkon kehittämis- ja rahoitusohjelma vuoteen 2020; Valtioneuvoston liikennepoliittinen selonteko eduskunnalle 27.3.2008. [Traffic policy and traffic network development and financing programme to 2020; Government transport policy report to parliament 27 March 2008] Traffic policy improves Finland's competitiveness. Functioning logistics and uninterrupted and punctual deliveries are key. The Government transport policy report stipulates that existing traffic lanes will be kept in working order through basic road service.

Liikenne 2030 - Suuret haasteet, uudet linjat [Traffic 2030 – Major challenges, new policies] (Ministry of Transport and Communications 2007) is a proposal by civil servants for future choices in traffic policy. The proposal was accepted by a civil service decision. The purpose of the proposal is to encourage debate in society on the direction of traffic policy and future policies. According to **Traffic 2030,** the reduction of climate change by cutting emissions, the functionality of everyday travel and maintaining Finland's competitiveness are the most important future challenges for traffic policy. The proposal highlights the importance of the high quality of the most important roads with the heaviest traffic, reducing head-on collisions on main roads, reducing bicycle and pedestrian accidents in urban areas, minimising the harmful effects of salt, and air quality in large cities.

The document **Liikenne- ja tieolojen tavoitetila** [The Target State of Traffic and Road Conditions] (Finnish Road Administration 2008) takes the traffic system vision of **Traffic 2030** toward practical implementation within the sphere of responsibilities of road traffic conditions and road service. The target state starts from the intention that winter maintenance of roads will be better than at present; however, taking into account the realities imposed by the weather, the difference will not be not very great. Financing for road service will have to increase in order to achieve the target state. The development of the road network and the improvement of the condition of roads also create opportunities for improving the conditions of winter traffic.

The document **Tienpidon strategia** [Road Service Strategy] (part of the Action and Financing Plan 2009–2013, Finnish Road Administration 2008) prioritises ensuring daily traffic capability (winter maintenance, ferry traffic, traffic management) as the most important operation in the basic road service. The Action and Financing Plan also states that investment in maintenance in accordance with the strategy enables the satisfactory maintenance and daily service of the road network.

Tiehallinnonympäristöohjelma2010-Kohtiekotehokastaliikennejärjestelmää [The Finnish Road Administration's Environmental Programme 2010 – Toward an Eco-Efficient Traffic System] (Finnish Road Administration 2006) is the manifestation of the Finnish Road Administration's intentions on environmental matters. Its key starting points are the environmental action objectives set for the Finnish Road Administration in the third environmental programme of the Ministry of Transport and Communications entitled "Traffic Policies in Environmental Matters to 2010" (Ministry of Transport and Communications 2005). The environmental programme states forcefully that one of the greatest challenges facing the road service today is mitigating climate change and adapting to change. The programme contains many matters connected to winter maintenance. One particularly important objective is to find the level of antiskid treatment that ensures mobility without reducing the quality of groundwater. The aim must be to reduce the use of anti-icing salt, particularly in areas that are sensitive to its impact (class I and II groundwater areas), research into alternative antiskid treatment substances and their effects must continue, and the timing and methods for the removal of sand used in sanding roads must be agreed together with municipalities.

The **Government Resolution on Water Conservation Policies to 2015** (Finnish Government 2006) proposes the objective that the qualitative and quantitative condition of groundwater is maintained at least at the present level, and in particular the maintenance of the quality of groundwater areas that are important for water supply (and other groundwater areas that are suitable for supplying water) in its natural state is ensured.

On 9 March 2006, the Government affirmed the objective set earlier in a resolution: The maximum possible number of deaths from traffic accidents in 2010 should be 250. The long-term objective of the **Traffic Safety Programme of the Ministry of Transport and Communications and the Finnish Road Administration (Ministry of Transport and Communications 2005, Finnish Road Administration 2008)** is continued improvement in traffic safety so that the number of deaths from traffic accidents is a maximum of 100 in 2025. The reduction of head-on collisions on main roads, reduction of pedestrian and bicycling accidents in population centres, reduction in accidents in professional road transport, and reduction in the consequences of accidents are objectives upon which winter maintenance can have an effect. The programme highlights the notification of road conditions not only for motorists but also for pedestrians and cyclists, connections to stops and pedestrian crossings and winter maintenance of bicycle and pedestrian lanes.

The Finnish Road Administration decides on speed limits on the basis of general guidelines given by the Ministry of Transport and Communications. In 2004, the Ministry issued a new **General Guideline on the Revision of Speed Limits in the Winter and During Dark Hours.** The guideline was made permanent in 2006. According to the guideline, the maximum speed limit during the winter months is 100 km/h. The basic requirement for the use

of the 100 km/h speed limit is the structural separation of opposing lanes of traffic. In practice, this means that the 100 km/h speed limit can be used on highways, other two-carriageway roads, and one-carriageway roads equipped with a central barrier. However, exceptions from this basic requirement can be made on low-traffic roads, roads with wide lanes, and roads equipped with a real-time changing speed limit system. These roads must have good traffic safety. The guidelines also allow the reduction of 80 km/h speed limits for the duration of the winter. The reduction can be justified on the basis of the high risk of accidents in residential areas along the road, a high volume of traffic considering the road conditions, and a high proportion of heavy traffic.

Section 33 of the Highways Act states that "a highway must be kept in a condition that is satisfactory with respect to general traffic. In determining the level of maintenance, the factors that are considered are the volume and quality of traffic, the significance of the road to traffic, the weather and its foreseeable changes, the time of day and other conditions. In addition to the smooth flowing of traffic and traffic safety, environmental perspectives must be taken into consideration in maintenance." With respect to limited maintenance, it is also stated that if there is a special reason, a part of a road can be shut off from general traffic or antiskid treatment can be omitted for part of a pavement or bicycle path belonging to the road.

Section 23 of the Road Traffic Act states that vehicle speed must be set at the level required by traffic safety, taking into consideration the physical state of the road, weather, road conditions, visibility and traffic conditions.

2.2 Customers' expectations for winter maintenance

Winter maintenance concerns all citizens and all sectors of society and the economy. The basic level of winter maintenance must provide the opportunity for reasonable mobility and transport, without compromising safety and the condition of the environment. Certain key customer groups also have special needs for winter maintenance. For lorry and bus traffic, the antiskid treatment

and its timing are key factors. The handling of an articulated vehicle in winter road conditions demands a great deal of experience, tyres suited for winter conditions, balanced loading of the vehicle and a suitable drawing vehicle. The volume of night-time lorry traffic continues to grow, so there is no more room to reduce the level of service during the night. The morning is the most critical time of day for bus traffic and commuters. Bus schedules do not have an extra margin to allow for winter road conditions, although Finland's winter conditions should absolutely be taken into consideration. On main roads in the largest cities, even small anomalies caused by slippery conditions or thick snow cover have a cumulative effect during rush hour in slowing down commuter traffic.

Good winter maintenance of connections to harbours is important in foreign trade. Other terminal connections are also important. Frost heave during the autumn, which has rapidly become more common, limits transports by the forest industry in the autumn and the shorter winter must be fully utilised in connections that are important for logging. There are major local needs (concerning certain routes) for winter maintenance, especially for antiskid treatment, for tourism companies, the special transport sector, the transport of hazardous substances and transit traffic. The basic services of society (the police, the Finnish Defence Forces and fire and rescue services) must operate under all conditions. Winter maintenance and antiskid treatment on bicycle and pedestrian connections is important for the disabled and those with impaired mobility. This is also important for comprehensive school pupils.

The most important matter is that the quality specified by the orderer is achieved through the desired level of service. Flexibility and interaction between customer parties, the contractor and the orderer is also important. It is a good idea, for example, to regularly coordinate ploughing routes and route traffic during a maintenance contract. It must be possible to respond to unforeseen, but justified, local and client-specific needs. Ultimately, this may require the client to pay part of the additional costs.

2.3 Traffic safety

Road casualties are more frequent on main roads and the sections of main roads with the heaviest traffic. Special attention should be paid to the quality of winter maintenance on main roads with high traffic volumes, although less than half of the winter-time accidents occur on these connections in winter road conditions. Fatal traffic accidents could also be prevented effectively on busy main roads by building central barriers. The improvement of the network of main roads with high traffic volumes so that it achieved its target level would thus also significantly improve winter traffic safety. The improvement of the speed limit system on low-traffic roads would also improve safety during the winter.

Traffic safety surveys covering recent years indicate that winter traffic safety has developed in a positive direction more clearly than summer traffic safety. The positive development has been boosted by the addition of winter speed limits and speed limits during dark hours, as well as automatic speed monitoring, which has been expanded considerably in recent years. The risk of accidents during the night has fallen relatively with respect to the risk of accidents during the day, both in the winter and in summer. During difficult road conditions, especially icy road conditions, the risk of accidents and especially death, is substantially higher than during summer road conditions. The latest surveys indicate that winter maintenance can have an effect especially on the safety of road users who observe traffic rules.

In Sweden, the risk of accidents in various kinds of winter road conditions, depending on the general state of the road conditions, has been studied on the basis of extensive material. As winter road conditions, especially icy conditions but also snowy conditions, become rarer, the risk of accidents in these road conditions increases. It is not possible to limitlessly improve safety by improving the level of winter maintenance. In Finland, the reduction of head-on collisions using road maintenance has been studied. In maintenance service classes Is, I and Ib, increasing the level of winter maintenance would be advisable and cost-effective as the savings in the costs of accidents exceed the additional costs of increasing the level of maintenance.

Although the development of safety during winter-time has been positive relative to the change in traffic volumes, achieving traffic safety objectives is very challenging and that is why additional efforts must continue to be made to improve the situation in winter maintenance. Winter conditions should be kept in mind when making other decisions, too: The use of the 100 km/h winter speed limits should be avoided on roads with a maintenance service class of under Ib and roads that are narrow or have other deficiencies.

2.4 The environment

The use of sodium chloride in antiskid treatment poses a risk to groundwater. Substitutes for sodium chloride have been sought, especially in groundwater areas. The effects of calcium chloride have been studied and it has been found that it has a more harmful effect on the built-up environment than sodium chloride. Although the effects of calcium chloride on the natural environment are of the same magnitude or slightly smaller than the effects of sodium chloride, the use of calcium chloride is not recommended. On the other hand, potassium formiate seems to be a promising substance in antiskid treatment, especially in sensitive groundwater areas. Its corrosive effects are being studied before it is taken more widely into use. A study has shown that potassium formiate does not cause problems for alphalt pavings.

An experimental reduction in road salting in the Uusimaa road district did not increase the number of accidents after several winters. Road users have been satisfied with the experiment.

It is important to notice that the means for achieving traffic safety and environmental objectives are to some extent contradictory from the perspective of antiskid treatment. The grip of the road surface is a key factor in traffic safety. If we wish to improve traffic safety, this will probably cause additional harm to the environment through increased use of salt or sand used in road sanding. Correspondingly, if the use of salt or sanding of roads is reduced, traffic safety problems will increase.

2.5 Communications and real-time control of traffic

The smooth flow of winter traffic requires sufficient winter maintenance and that road users are aware of the prevailing road conditions and anticipate and prepare for the prospective road conditions. A forecasting and warning service was developed in the 1990s to help in anticipating road conditions, which predicts the driving conditions on roads in the next 24 hours for each province. New forecasts are issued three times per day, or more often if required. In the forecasts, driving conditions on roads are divided into three categories: normal, poor and very poor driving conditions. The class is determined on the basis

of the weather, road conditions, maintenance measures, speeds of drivers, feedback and disruptions. Based on ten years of experience, it is possible to conclude that 60–70% of the winter-time consists of normal road conditions, 27–35% consists of poor road conditions, and 2–5% consists of very poor road conditions.

According to expert assessments, the effective provision of information on road conditions can reduce accidents causing bodily injury by 10% during the winter-time. Based on ten years of monitoring, we can conclude that three weather phenomena cause the most problems for motorists, during which there are at least twice as many accidents than on average winter days.

The most common cause of problems is an area of low pressure arriving from the west and moving over Finland or along a path to the south of the country which brings with it heavy snowfall and at the same time the temperature is well below freezing. A frozen and slippery situation in which there is light or moderate snowfall and the temperature is below minus 10 degrees Celsius can catch drivers unawares. No good methods of countering freezing and slippery conditions have yet been found. The third problematical situation for drivers is great variations in temperature, when frost forms on the road or road surfaces freeze or the air warms quickly.

Notifications and warnings of road conditions can reach drivers setting off, or already on the trip, via the radio, television, mobile phones, and car navigators. Communication is supported by road condition warning signs along some roads (300 km) and speed limits that vary according to the road conditions. Notification and guidance is most important when the danger to be avoided cannot be visually detected or when the contractor no longer has the time to keep the road in the desired condition.

3 KEY POLICIES

The following polices are followed in winter maintenance:

Consistent level of service on traffic links

Efforts are made to keep the level of service on the road network sufficiently consistent on traffic links from the perspective of the road user, regardless of administrative borders, contract areas or differences in traffic volumes. Maintenance borders are agreed for locations that are suitable for traffic. To maintain a consistent level of maintenance, it is important that real-time cooperation and communication functions between different contractors and contract areas. Nevertheless, regional differences in climate and variations in weather cause natural variations in driving conditions.

Consistent level of service around the clock

Quality requirements during the night are raised to the same level as during the day. This ensures the safety and functionality of night-time transports, which are becoming more common all the time. At the same time, it is ensured that maintenance measures are carried out before the morning commuter and school trip traffic. The level of service is as balanced as possible at all times of the day and night. Quality requirements are clarified and made more unambiguous.

The level of service is adjusted and controlled on a local and temporal basis so that the needs of customers and the conditions of the roads are taken into consideration.

Consistent principles are followed throughout the country in the classification of the maintenance and the quality requirements of the road network. Nevertheless, common principles are applied according to regional and local needs and conditions. In particular, differences between climate zones are taken into consideration. Even on roads with the same level of service, the needs of customers vary depending on the time and place. These are taken into consideration sufficiently when the policy guidelines are applied, both when the service level class is decided and precision maintenance sites are specified. Precision maintenance sites are defined in the road district when winter maintenance is planned and are specified when the maintenance contract procurement is prepared. Nationally consistent principles are followed in the specification of precision maintenance sites.

Winter maintenance provides the opportunity for safe travel during the winter. Antiskid treatment on busy roads will be improved in order to prevent accidents.

Winter and the level of winter maintenance have a significant impact on traffic safety. The objective is that the traffic safety risk during the winter is no higher than during other times of the year. Since winter naturally reduces the driving conditions of the road network, it is important for the purpose of traffic safety that the level of maintenance is as balanced and as predictable as possible. The aim is to avoid surprising boundaries and other momentary variations in the level of quality. Antiskid treatment on the busiest roads will be improved in order to improve safety. The safety of winter traffic requires the coordination of

the level of service and speed limits and that the road maintenance authority helps road users to prepare for exceptional and risky conditions through the provision of information on road conditions. Winter maintenance also supports the implementation of traffic control.

On the busiest and most congested stretches of roads, winter weather will not cause significant additional delays.

The effectiveness of winter maintenance will be improved on the sections of roads most susceptible to congestion and disruptions. Antiskid treatment and snow ploughing will be carried out so that winter road conditions do not cause additional delays, vehicles are able to continue quickly after traffic lights and bus stops, and vehicles entering from slip roads can join traffic as smoothly as possible. The implementation of winter maintenance measures is challenging on the busiest roads and requires more careful than normal observation of traffic, risk management and preparation for risks.

The service level is set cost-effectively. The basic level of service will usually be maintained even on low-traffic sections of the road network.

With respect to efficiency and good effectiveness, the maintenance quality level will be set step-wise according to the use of the road. The aim is to achieve the best possible benefit-cost ratio on the road network. The basic level of service is guaranteed even on the low-traffic sections of the road network, which enables travel around the clock in normal conditions.

There are clear operating procedures in case of exceptional weather conditions

Travel can become significantly more difficult in exceptional weather conditions, which occurs a few times during the winter. Exceptional weather conditions will probably become more frequent as a result of climate change. Under exceptional conditions, the safety of traffic is ensured, as well as the reasonably smooth flowing of the most important traffic lanes. The most important methods are clearly agreed procedures and careful advance planning. It should be ensured that the contractor is able to do its work under exceptional conditions. Good maintenance during exceptional weather conditions does not produce additional sanctions for the contractor if the operations are in accordance with the operational and quality plan. A contractor must reserve backup equipment for the maintenance of the very busiest sections.

Environmental impacts are kept under control in groundwater areas. Replacements for sodium chloride are being sought in groundwater areas. Harm to air quality in urban areas will be reduced through cooperation.

Anti-icing salt affects the condition of groundwater, while sand used for sanding roads increases the formation of dust and its use has an impact on the amount of non-renewable natural resources. The total amount of salt used is increasing somewhat due to the tightening of quality requirements resulting from the increase in traffic volumes and the changing conditions caused by climate change. Contractors must have the ability to use salt correctly and precisely so that the use of salt stays within controllable margins without compromising traffic safety. The risk to groundwater will be reduced in particular by reducing the use of salt locally in sensitive groundwater areas or by replacing sodium

chloride with a biodegradable substance for antiskid treatment. The intention is to reduce the use of calcium chloride to reduce the impact on structures. By choosing the right material to use for sanding, it will be possible to try and increase the benefits obtained from sanding while reducing harm from dust in densely populated areas. The removal of sanding material from roads and streets will be timed to coincide as exactly as possible, and the methods are being developed through cooperation.

The provision of information on road conditions will improve the opportunities for road users to have an impact on safe and smooth winter travel.

Travel in winter conditions requires adjusting the methods of driving and travelling and making preparations made according to the weather and conditions in all conditions. The provision of information on winter traffic supports the opportunities for road users to operate safely and responsibly. The provision of information on road conditions supports the ability of as many road users as possible to acknowledge the present and future road conditions and take this into consideration in planning travel and transports and while operating in traffic. Messages that change instructions correspond to the actual road conditions and guide road users in travelling safely. The information on road conditions is sufficiently precise and reliable and is available to everyone.

By improving cooperation between road maintenance authorities, it will be possible to avoid surprising differences in the quality of maintenance when crossing the border between the areas of two road maintenance authorities.

The borders between roads and streets should not be visible to road users. Cooperation on the winter maintenance of bicycle and pedestrian roads between the State and municipalities is intended to harmonise the level of maintenance of the lanes and the timing of maintenance measures. Surprising borders and differences between the level of service also pose a risk to bicycle and pedestrian traffic. Falls and accidents caused by slipping can be prevented through antiskid treatment that starts sufficiently early in the morning. The timing and coincidence of maintenance work on carriageways and bicycle and pedestrian lanes, especially snow ploughing, must not cause problems.

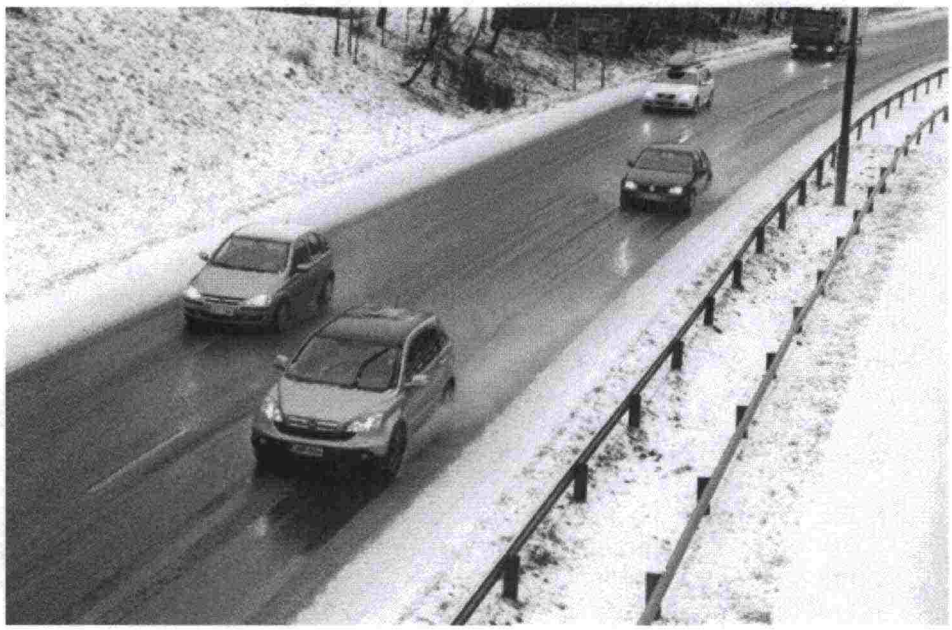
The operational preconditions of public transport will be supported through targeted winter maintenance.

The competitiveness of public transport will not be reduced during the winter due to winter maintenance; bus stops and connections between stops will be taken care of sufficiently early. Special attention will be paid to stops that are important for school transport and the school transport routes themselves.

The achievement of good quality is emphasised. Spot checks will be performed to monitor the achievement of quality requirements

Road maintenance contracts are quality responsibility contracts in which the contractor has the main responsibility for achieving the ordered quality. The role of the contractor's operating and quality plan will be enhanced. The orderer's quality assurance operations must be sufficient to ensure that the actual quality delivered corresponds to the ordered quality. The rules for monitoring quality will be clarified and harmonised. Quality requirements will be formulated to be

as clear as possible so that the main contractor, subcontractors and orderer all understand them in the same way. Maintenance contracts are long-term, while the needs of customers and the rest of the operating environment changes quickly. During the period of the contract, it is often necessary to make changes in maintenance classes, quality requirements and precise-maintenance targets. The intention is to make it easier to make such changes.



4 THE LEVEL OF SERVICE OF THE ROAD NETWORK

A uniform classification of the level of winter maintenance of the road network is used throughout the whole country. The level of service is determined according to the traffic volume, traffic composition, operational class and the climate of the area.

The road network is divided into five main maintenance classes (Is, I, Ib, II, III) in addition to which there is maintenance class TIb for urban areas which corresponds to class Ib. Each class has its own distinct level of service and quality requirements that differ from the other classes. Road classes are decided according to the links in the road network so that they flow smoothly clearly from the point of view of users and quality differences do not provide surprises.

When deciding the maintenance class of the road, in addition to the class criteria, the following criteria are also taken into consideration: local conditions, the nature and composition of traffic, and the connection (in terms of quality) to the level of service in the municipality's road network. The road's speed limits are set so that they match the level of winter maintenance.

The criteria for a higher service class are:

- a large volume of heavy traffic
- the road has a much higher than normal amount of export shipments, transit traffic, shipments of hazardous substances, special deliveries, regular bus traffic or school taxi traffic.
- the road's geometry on the main road network is such that safe travel requires enhanced winter maintenance.

Correspondingly, the criteria for a lower service class are, following traffic calculations, a reduced or clearly diminishing need for travel. The maintenance classes must also be logical with respect to the manner of implementing the maintenance, because maintenance measures are carried out mainly as connected maintenance links. The maintenance class can be lowered from the standard level for reasons connected to the efficient and economical implementation of the maintenance.

Light traffic roads are divided into two service classes (K1 and K2) as links. In this way, measures on different roads can be timed so that they serve the traffic of the roads as well as possible in real-time, especially commuter traffic, connections to public transport, schools, day care centres and services.

The road network is divided into maintenance classes in accordance with the following figure.

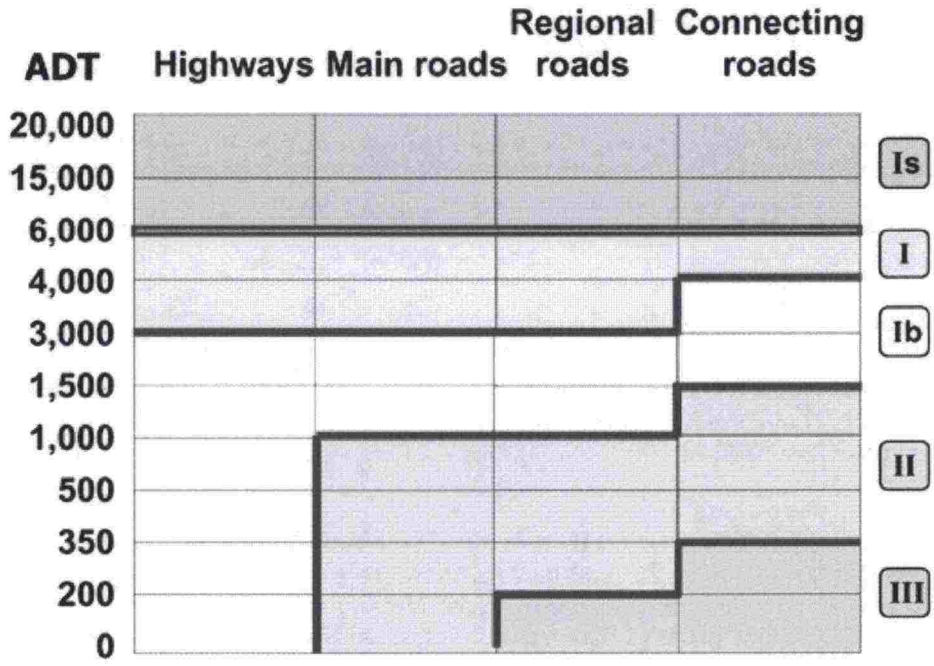


Figure 1. Rough division of the road network into winter maintenance classes

4.1 The level of service in different maintenance classes

Maintenance class Is
The road is clear except during changeable weather situations. In central and northern Finland, and during cold periods in the southern part of the country, there may be some long, thin patches of compacted snow on the road that do not particularly impair driving. During long periods of sub-zero temperatures, when the use of salt is not possible, the surface of the road may be partly icy. Slippery conditions are primarily prevented through proactive measures.

Busy roads, with an ADT of over 15,000, are always clear except during exceptional conditions (Section 4.4) and long periods of sub-zero temperatures. On these roads, antiskid treatment is always carried out through proactive measures. Due to the high volume of traffic, on busy roads salt can be used outside the normal temperature limits (-6°C in the Is class).

Maintenance class I
The road is clear most of the time or it may have long, thin patches of compacted snow in between carriageways and roadways. The road may be slightly slippery during situations in which the weather is changing. The intention is to prevent problem situations because of slippery conditions through proactive antiskid treatment.

Maintenance class Ib
The road is maintained at a high quality, but mainly without salt. Depending on the volume of traffic and weather, the surface of the road is partly clear, partly covered with patches of compacted snow, or the road may be entirely covered with compacted snow. With the exception of problem situations, the road has good winter road conditions; antiskid measures are not carried out to the same level, but the road is sufficiently safe if road users take the prevailing conditions into consideration. Patches of compacted snow, or a layer of compacted snow, are levelled out to be as smooth as possible. Slippery conditions are prevented by using salt mainly during slippery conditions in the autumn and spring, or in similar "warm conditions", as well as in certain problem situations. During mid-winter, sanding in points and lines is used when necessary.

Maintenance class TIb (urban area)
The roads are covered with a layer of compacted snow during mid-winter. The quality is similar to the quality on Ib roads, but the road may have thicker patches of compacted snow, which do not cause problems for traffic due to the low speed limits.

Maintenance class II
The road is mostly covered by a layer of compacted snow or, depending on the volume of traffic, the compacted snow may occur partly in patches. In normal conditions, the road is sufficiently treated for antiskid and smooth for a moderate level of traffic. Intersection areas, hills and curves are sanded so that driving is safe under normal conditions. The road is sanded completely during problem situations. During difficult weather conditions, such as when the weather suddenly becomes milder, during freezing rain, or immediately after snowfall, road users must be especially careful.

Maintenance class III
The roads are covered by a layer of compacted snow most of the time, and there may be ruts in some places. During periods of sub-zero temperatures, the driving conditions are mostly satisfactory, but may vary in some places. When the weather changes, and especially during freezing rain on layers of compacted snow, the road conditions may be problematic for several hours, during which great care must be exercised when driving.

4.2 Bicycle and pedestrian lanes

K1
Road maintenance is carried out in the mornings before school trips and commuter traffic and serves the needs of leisure time travel during the evenings and week-ends. The level of maintenance allows bicycling, and the use of prams, wheelchairs and walkers.

K2
There is usually also a certain amount of school trip and commuter traffic on the roads. Following the maintenance measures, the level of quality is almost the same as on K1 roads, but the maintenance measures are carried out later than on K1 lanes.

4.3 Urban areas

For the most part, normal maintenance classes are used in urban areas. In urban areas in which the traffic differs from other roads in the maintenance class due to the area's special conditions, lower speed limits, or different modes of travel or types of trip, the quality requirement of the maintenance class is changed so that it better corresponds to the nature of the traffic and the activities in the area. The use of salt is avoided whenever possible on roads in urban areas.

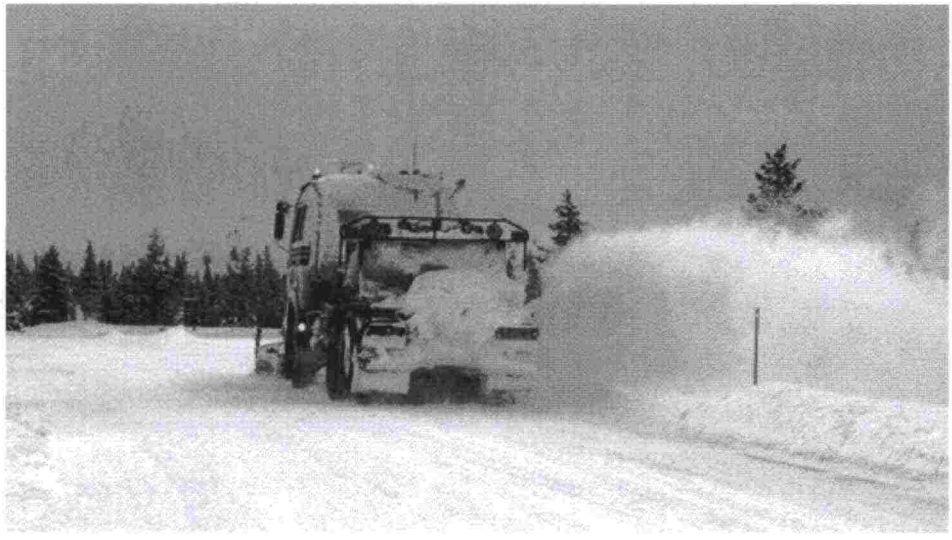
A densely populated area located along a class I or Ib road is maintained normally according to the TIb class. The urban area class is used in an area indicated by an urban area road sign or on separately defined sections of the road. The urban area class is not used for bypasses in urban areas or in situations in which a change in the class is not necessary due to the operations of the urban area or the road.

4.4 Policies during exceptional weather conditions

On average, exceptional weather conditions occur a few times a year. A snowstorm is considered to be exceptional when at least 10 cm of snow falls continuously during a four hour period. A situation in which snowdrifts are being formed is also considered to constitute an exceptional snowstorm when the following four conditions are met simultaneously:

- There is continuous snowfall of at least 5 cm for four hours.
- The air temperature is -2°C or lower during the snowfall.
- There is a strong wind during the snowfall which exceeds 8 m/s in gusts.
- The falling snow is dry and forms large snowdrifts.

Under exceptional conditions, the safety of traffic is ensured, as well as the reasonably smooth flow of the most important traffic lanes, especially for heavy traffic. The key factors are careful advance planning, acting as fast as possible, the full use of the capacity of the main contractor and subcontractors, and increasing the salt quota when necessary. It is ensured that the contractor is able to carry out its work under exceptional conditions. Good maintenance during exceptional weather conditions does not produce additional sanctions



for the contractor if the operations are in accordance with the operational and quality plan. The contractor must indicate extra equipment in its operating and quality plan for the maintenance of the busiest roads.

Careful advance planning encompasses separate specifications of quality requirements for exceptional conditions, proactive quality assurance measures, as well as the sufficiency, organisational readiness and competence of the contractor's resources. The orderer prioritises the road network from the perspective of exceptional weather conditions in the road district's maintenance and service plan, for example.

Communication between contractors and different contract areas is also important, especially for the implementation of maintenance measures on main roads. The contractor's internal quality assurance must cover the abovementioned matters, including for the operations of subcontractors. Agreements on how to organise operations if the situation becomes exceptional (resource aid, helping the authorities) must be prepared in advance. As a part of its operating and quality plan, the contractor must present a contingency plan for operations during exceptional weather conditions, so as to ensure reasonable traffic conditions in the section of the road network affected by the problems.

Quality must be returned to normal as quickly as possible in exceptional weather conditions, with the contractor using all of the equipment specified in its operating and quality plan. Even in exceptional weather conditions that last a long time (when the rules on rest periods enter into force), quality must be returned to normal within half a day on roads with maintenance class Is, I and Ib (in the morning before commuter traffic) and on other roads within one day.

4.5 Taking into consideration the special needs of traffic

Precision maintenance
Due to the special needs of customers, the method of maintenance, its timing or quality can be changed locally without changing the maintenance class. Only a limited number of precision maintenance sites like this will be specified. Quality requirements that differ from the national quality requirements are effective in precision maintenance sites. Precision maintenance sites are surveyed and defined in the road district when winter maintenance is planned, and they are specified in the task-specific specifications of the contract when the regional procurement is being prepared. Other special sites can also be indicated in the task-specific specifications, which the contractor should be aware of, but in which the quality requirements have not been changed. These may include roads used for peat and timber transports, as well as busy bus stops and lanes that are frequently used by bicycle and pedestrian traffic.

The following principles are used in defining precision maintenance sites:

- The volume of traffic, or the distribution of vehicles, differs to such an extent from the normal in a certain section of the road, or a certain link, during a limited period that it requires a change in the quality. These situations may include, for example, special deliveries, events involving a very large number of people, and congestion peaks at sports centres.
- An unusual distribution in the time of traffic requires a change in the scheduling of maintenance.

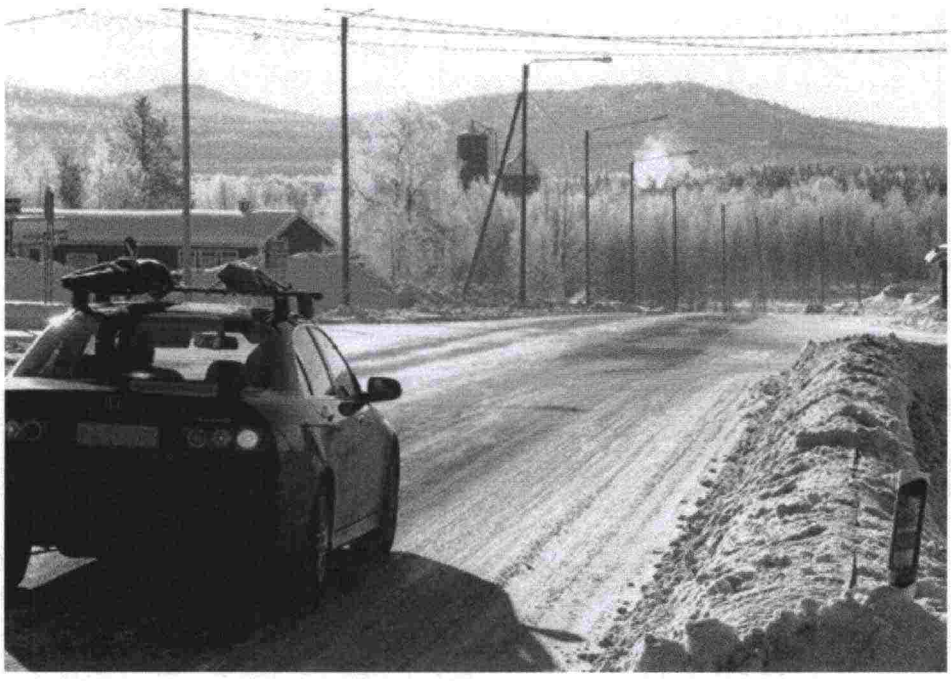
- An anomalous or dominant direction of traffic requires that maintenance is carried out in a different order.

In addition to the abovementioned precision maintenance sites known in advance, an allowance to make different arrangements is reserved in the contracts to enable timber transports in individual felling sites and other unforeseen transports.

Quality on holidays

The dedication to service and customer-orientation of winter maintenance requires that a good level of maintenance is ensured during periods in which there is much more traffic than normal on the road network and the nature of traffic is different than normal. Such times include Christmas, New Year, Easter and the traffic peaks during winter holidays. During these times of year, there is more long-distance traffic than normal. At such times of the year, people often drive in unfamiliar environments and there are more inexperienced winter drivers than normal. During these periods, precision maintenance is focused on outward and return journeys along the most important tourist traffic routes. Road districts define which sections of road will be covered by a holiday quality service in their maintenance and service plans and also in the task-specific specifications of regional contracts.

Holiday quality means the performance of certain normal measures proactively before the traffic peak and good maintenance readiness in case of changes in the weather. From the point of view of good customer service, it is important that the road is well ploughed, including hard shoulders, overtaking points and other broadenings of roads, intersections, bus stops and traffic inspection locations. It also means that the layer of compacted snow on a road is smoothed, sand is applied to spot sanding locations and traffic signs and marker posts are cleaned before traffic increases.



5 DESCRIPTION OF QUALITY

The following describe the key maintenance quality requirements which give a general picture of the quality of the carriageway and its differences between maintenance classes. The quality requirements are presented in more detail in the quality requirements of the contracts. The quality requirements described here only concern the actual carriageway.

The quality of winter maintenance is defined on the basis of the following factors:

- friction (the friction scale 0.00 ... 1.00 is tied to the description of the road surface conditions)
- the friction temperature limit (on Is and I class roads with salt, the friction requirement is lower below the salt temperature limit)
- maximum snow depth (amount of snow and slush that cannot be exceeded during snowfall)
- ploughing threshold (when the amount of snow and slush exceeds this threshold, ploughing must be started no later than this)
- smoothness (ruts and unevenness in roads)
- times of the measures (time from the moment the quality falls below the right level or from the end of the snowfall to the completion of the maintenance measure)

5.1 Antiskid treatment

Table 1. Quality requirements for antiskid treatment

Winter maintenance class	Is	I	Ib and TIb	II	III	K1	K2
Friction requirement	0.30	0.28	0.25	Roughened surface, problem locations are spot sanded	Roughened surface, problem locations are spot sanded	According to the needs of traffic	According to the needs of traffic
Must be considered	Road surface below -6°C 0.25	Road surface below -4°C 0.25	Spot sanding 0.25, line treatment 0.22			after 10 p.m., by 6 a.m.	after 10 p.m., by 7 a.m.
Time to carry out measure when falls below	2h, on busy roads 0h	2h	salt 3h sand 4h	Line sanding of icy compacted snow 6h	Line sanding of icy compacted snow 8h	2h	3h

Table 2. Correspondence between the friction value and road conditions

Friction value	**0.00 – 0.14**	**0.15 – 0.19**	**0.20 – 0.24**	**0.25 – 0.29**	**0.30 – 0.44**	**0.45 – 1.00**
Description of the road surface	wet ice, **very slippery**	icy, **slippery**	smooth compacted snow, **fair winter road conditions**	antiskid compacted snow and ice **good winter road conditions**	clear and wet, **antiskid road conditions**	clear and dry, **antiskid road conditions**

- The friction requirement must be satisfied on at least half of the surface area of the carriageway
- The friction requirement of Is and I roads is 0.25 when the temperature of the road surface is colder than the limit value.
- In classes Is and I, freezing situations are prevented in advance using salting so that slippery conditions are avoided and at least the harm and duration of the slipperiness are minimised.
- On busy roads with ADT > 15,000, freezing situations are prevented in advance using salting so that slippery conditions are avoided.
- In class Ib, sufficient antiskid treatment is required when the friction value is less than 0.25. The whole length of the road must be treated at the latest when the friction value is expected to fall below 0.22.
- In maintenance class TIb (urban areas) salt is mainly used only in extraordinary slippery conditions.
- A roughened surface is required in classes II and III.
- In class II, antiskid treatment in accordance with the rules is implemented so that mobility is ensured in all conditions. In exceptionally problematic road conditions, the whole length of the road is sanded.
- In class III, special problem sites are spot sanded so that driving remains possible on the road. In exceptionally problematic road conditions, the whole length of the road is sanded.

5.2 Snow and slush

Table 3. Quality requirements of snow removal

Winter maintenance class	Is	I	Ib and TIb	II	III	K1	K2
Maximum depth of snow during snowfall	**4cm**	**4cm**	**4cm**	**8cm**	**10cm**	**3cm**	**4cm**
Time to clear after the end of snowfall	**2.5h (slush 2h)**	**3h (slush 2.5 h)**	**3h**	**4h**	**6h**	**3h**	**4h**

- Ploughing must be started at the latest when half of the maximum depth has accumlated on the ground (so-called 'threshold')
- Maximum snow depth must not be exceeded during snowfall and after that while the measure is being carried out.
- Only half of the snow can be slush.
- The time to carry out the measure starts when the snowfall ends and ends when the traffic lanes have been cleared.
- If the snowfall ends after 10 p.m., K1 class roads will be ploughed by 6 a.m. and K2 class roads by 7 a.m.

5.3 Smoothness of the road surface

Table 4. Quality requirements of the smoothing of the road surface

Winter maintenance class	Is	I	Ib and TIb	II	III	K1	K2
Maximum depth of snow during snowfall	**4cm**	**4cm**	**4cm**	**8cm**	**10cm**	**3cm**	**4cm**
Time to clear after the end of snowfall	**2.5h (slush 2h)**	**3h (slush 2.5 h)**	**3h**	**4h**	**6h**	**3h**	**4h**

- During cold periods when salting is not possible the smoothness requirement of maintenance class Is is 1 cm
- Thin ruts and other irregularities in the compacted snow must not significantly impair driving

5.4 Bicycle and pedestrian lanes

The key requirements are:

- Correct timing of maintenance, which prevents the possible movement of the traffic onto the carriageway.
- Sufficient friction to ensure safe travel.
- Snow barriers do not prevent bicycling and the use of prams.
- Normal quality requirements are in force in class K1 from 6 a.m. to 10 p.m. and in class K2 from 7 a.m. to 10 p.m. The maintenance measures must be completed in the morning by 6 a.m. or 7 a.m. if this is required by the timing for the measures.
- Outside the planning zone, an unsanded strip can be left on the outside border of a wide bicycle and pedestrian lane for use by sledges.
- The layer of compacted ice on a bicycle and pedestrian lane that borders immediately on a road is kept sufficiently horizontal to ensure that bicycle traffic does not drift into the road or pose a danger to pedestrians.
- The ploughed smoothened surface of bicycle and pedestrian lanes is roughened.
- In the spring, slushy layers of compacted ice are removed sufficiently to facilitate bicycling.

6 IMPLEMENTATION OF THE POLICIES

In the implementation of the policies, it is important that the entire road maintenance process functions toward the same objective, by following the same common policies and principles. The maintenance process has not traditionally included a clear product planning phase; rather, the product (service) has been described in policies, quality requirements, in the contract agreement and the contractor's operating and quality plan. In the future, the overall maintenance and service provision will be planned in the road district's maintenance and service plan. Winter maintenance is characterised by the fact that the product is taken into use immediately. Proactive quality assurance plays a particularly large role in the achievement of the end result. The reporting of winter maintenance includes the agreement, implementation, the realised product (road conditions/quality of the road) and the reporting of customer feedback.

6.1 The actions of the Finnish Road Administration in quality assurance

The agreed maintenance level of the road network and the main principles that support it are agreed in the policies. The key elements in assuring the achievement of the intended quality are quality requirements (general and task-specific), the contractor's operating and quality plan, the selection of a competent contractor, the skilled performance of tasks by the contractor, and well-designed monitoring and quality control. Delivery requirements and a bonus system that improves the commitment to service are comprehensively in use in the procurement of maintenance. Winter maintenance is carried out in real-time according to the weather and situations, and the orderer cannot monitor all the operations. The orderer must assure in advance that the right quality will be achieved, and the contractor must internalise the principle of responsibility for quality. In addition to the content of the contract agreement, the contractor and the subcontractors must also understand what the purpose of the operations is and what effects the implementation of the operations will have on traffic. The role of the contractor's operating and quality plan will be enhanced.

Efforts will be made to implement the right quality and it will be ensured that the orderer's quality assurance operations are adequate. The rules for monitoring quality will be clarified and harmonised. Spot checks will be performed to monitor the achievement of quality requirements.

The real-time monitoring of the weather and road conditions plays a key role in the entire road network. It controls the timeliness of the operations, which has a material impact on the level of service and quality experienced by road users. The role and content of the operating and quality plans emphasise the objective of well-timed management of situations, seamless cooperation between contracts, environmentally friendly and safety-oriented operating methods and the commitment to service. For this reason, it is of the utmost importance that the orderer verifies through audits that all of the contractor's personnel participating in the maintenance work operate according to the operating and quality plan. The specified plan also functions as the winter maintenance plan, which contains the matters that have the key impact on the work, such as operating routes and the assessment of resources.

6.2 Reporting of winter maintenance and monitoring quality

The ex post facto monitoring of winter maintenance requires that reporting covers the following areas of the service:

- the costs of winter maintenance
- implementation of agreements
- the quality and level of service of the road network
- successfully meeting the needs of customers
- description of traffic safety in the winter-time
- information on environmental impacts and the consumption of substances used in antiskid treatment
- description of the smoothness of flow of winter traffic
- account of the prevailing weather

By applying the above principles, winter maintenance is reported within the Finnish Road Administration by contract, road district and at the level of the entire Finnish Road Administration. With respect to costs, it is important to manage the costs by maintenance class. This is the only way to compare the price levels between different areas. The implementation of the agreements and the contractor's overall success in winter maintenance and commitment to service are reported in the contract supervisor's (road inspector's) personal assessment, through the results of road user satisfaction surveys, as well as through the number of anomaly reports, reminders, fines and bonuses. The level of service and quality of the road are reported through centralised quality monitoring based on random samples. The monitoring of quality should be carried out each winter, as there is no other comparable national measurement data on the success of winter maintenance.

A contract-specific satisfaction survey carried out once a year provides a picture of the perceived success of the winter maintenance and especially of its development, and functions as an indicator of the customer satisfaction bonus, together with the assessments of the contract's supervisor. This is very important especially for the low-traffic sections of the road network because the extension of the monitoring of quality so that it is statistically comprehensive enough over the entire road network is difficult and expensive. The information provided by the feedback systems is used mainly in contract-specific control and monitoring, but – after being processed statistically – the development of the volume of feedback gives a general indication of what the problems experienced by road users are. It is a good idea to assess the success in responding to the needs of customers as a whole, by customer group and based on perceived and measured data.

In environmental reporting, the amounts of salt used are monitored by maintenance class, as well the total amount of sand used in sanding roads. The condition of groundwater areas that are close enough to be affected by roads is monitored through the national network for monitoring the amount of chlorides. The free flow of winter traffic is evaluated on the basis of the data obtained from automatic measurement points, although it is advisable to develop the methods for evaluating the free flow of winter traffic in the future by, for example, utilising travel time data. The account of the prevailing weather is reported each month and for each winter season on the basis of the winter maintenance weather index.

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8 APPENDICES

Appendix 1. Key changes compared to the earlier policy

Appendix 2. The intended effects of the policies

Appendix 3. The operating environment of the winter maintenance of roads

Appendix 4. Traffic safety during the winter season

Appendix 5. Winter maintenance classification of highways and main roads (to be included before printing)

KEY CHANGES COMPARED TO THE EARLIER POLICY

- Instead of just winter maintenance, winter traffic is treated more broadly. More precise quality level objectives and quality requirements are only defined for winter maintenance.
- It is emphasised that in situations with changing weather, problematic road conditions will inevitably occur, for which road users must be prepared.
- The needs of customer groups form the foundation of the policies in a more diverse way than before.
- The level antiskid treatment on very busy roads (ADT > 15,000) will be improved and slippery road conditions will be prevented in advance.
- The level of service during the night will be raised to the same level as during the day in all maintenance classes.
- In the Ib maintenance class, the friction limit will be increased across the board to 0.22 (it was previously 0.20–0.22).
- In maintenance classes II and III, the smoothness requirement for layers of compacted snow will be improved to 2 cm from 3 cm.
- In maintenance classes II and III, the formulation of the friction requirement (for surfaces of compacted snow) will be changed (friction according to the needs of trafic → roughened, problem locations will be spot sanded, wet ice will be line sanded)
- The level difference between the maintenance classes K1 and K2 of bicycle and pedestrian lanes will be emphasised.
- The timing of snow removal and antiskid treatment of bicycle and pedestrian lanes will be moved closer to the requirements of municipalities (5/6 a.m. -> 6/7 a.m.)
- The flexibility of sanding will be increased by reserving greater flexibility in contracts in the case of unforeseen sanding needs.
- The level of service during and after exceptional weather conditions will be specified.
- Quality control will be improved and it will be better connected to the operating and quality plans.

THE INTENDED EFFECTS OF THE POLICIES

The level of winter maintenance will be raised slightly. Together with improved quality assurance, this will result in a slightly better level of service than before. Here we shall examine the intended effects of the changes in winter maintenance policies.

Examination of the effects by area of effect:

Traffic accessibility will improve slightly
The operating model for exceptional snowfalls will reduce disruption to traffic and restrictions and obstacles resulting from the weather. Other improvements in the level of quality will also reduce restrictions. The free flow of the connection and the comfort of travel will improve slightly; in particular, the susceptibility of the busiest roads to disruptions will decrease. The slightly improved free flow of traffic will slightly reduce travel and transport costs.

Traffic safety will improve
The effects of the changes in policies on safety have been evaluated comprehensively. The key changes in winter maintenance requirements can be divided into four classes, namely a) an increase in the friction requirements, b) reduction in the time taken to carry out measures connected to the friction requirement, c) tightening of the maximum snow depth requirement and d) reduction in the time taken to carry out measures connected to the accumulation of snow. These have been changed to correspond to increases in the winter maintenance class. The level of traffic affected by the changes has been evaluated for each maintenance class. When the amount of traffic is multiplied by the average risk of accidents causing bodily injury during the winter season in the maintenance class, an estimate is obtained of how many accidents the impact on safety will affect. The improvement in the level of maintenance is estimated to reduce accidents by a minimum of 2% (TARVA calculation program) and a maximum of 12% (Norwegian estimate). This means that the proposed changes will reduce accidents causing bodily injury by 4–26 cases. The calculation includes many recognised factors of uncertainty, such as the shortening of winters and the difficulty in estimating the effect of increasing the roughness of layers of compacted snow.

Rough calculations indicate that the additional costs of the changes in quality requirements will be EUR 5–6 million during the winter season. Therefore, the cost of reducing the number of accidents causing bodily injury by one is EUR 0.2–1.5 million. Over the past few years, the number of registered traffic accidents causing bodily injury has been approximately 12.9 for each fatal road casualty. Based on this ratio, the price of the prevention of one fatal road casualty is EUR 2.5–20 million. The effectiveness of the changes in the level of winter maintenance in improving safety can be estimated to be average or slightly worse than average.

The changes will have no appreciable effect on accidents caused by slipper conditions. The roughening of surfaces of compacted snow has a particularly large impact on reducing the extent to which traffic is experienced as being dangerous.

Environmental impacts will remain unchanged
The use of salt will increase by an estimated 5–10% as a result of the changes. In groundwater areas, the intention is to replace sodium chloride with other substances used in antiskid treatment. The changes in winter maintenance policies will not have any appreciable effect on the development of the chloride content in groundwater areas.

Impact on human beings will remain unchanged
Morning commuter traffic will be slightly smoother than before because from now on the level of winter maintenance during the night will be as good as during the day. The intention is to reduce dust and air pollution problems in the Helsinki area through cooperation.

Road service costs will increase, driving costs will fall slightly
According to a rough estimate, road service costs will increase by EUR 5–6 million during the winter season. Costs will increase as the new requirements are introduced – by about EUR 2 million during the 2009–2010 winter season and gradually thereafter up to EUR 5–6 million. The changes will slightly reduce the driving costs of households and companies. The indirect economic effects will be slightly positive.

As a part of road maintenance, winter maintenance has an indirect impact on the urban structure and regional development. The policy changes will have no other appreciable effects.

Effects examined by customer group:

Strategic customers
The improved antiskid treatment on very busy roads will improve the safety and smoothness of travel of commuters, lorry transports and all other users of very busy roads. The improved level of service during the night will be especially beneficial to heavy traffic (foreign trade, wood procurement by the forest industry and providers of goods transport services). The increase in quality requirements for maintenance classes II and III will improve the conditions and safety of regular traffic (commuting, school transports) and heavy traffic. The specification of the level of service during and after unusual snowfalls will reduce the disruption to heavy traffic, in particular, which has a much longer impact on the logistics process than traffic disruptions.

The large amount of heavy traffic, export shipments, regular bus traffic and school taxi traffic are one criterion for raising the maintenance class. Timber transports, busy bus stops and verges of roads used extensively by bicycle and pedestrian traffic will be taken into consideration when specifying precision maintenance sites.

Customers with special needs
The routes and volumes of transit traffic, special deliveries and transports of hazardous substances are examined when specifying the maintenance class and precision maintenance sites. The changes will certainly benefit customers with special needs, basic service customers and strategic customers.

THE OPERATING ENVIRONMENT OF ROAD WINTER MAINTENANCE

The following figures illustrate order of magnitude data on the winter maintenance of the road network, its targeting and climactic conditions.

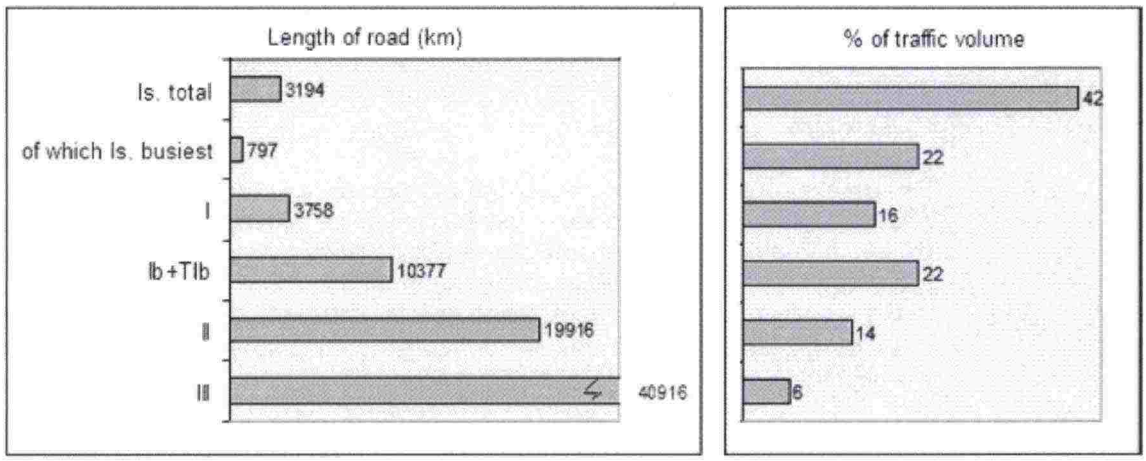


Figure 2. Lengths of roads and share of traffic volume by maintenance class (1 January 2008) The busiest roads means roads with an ADT of over 15,000.

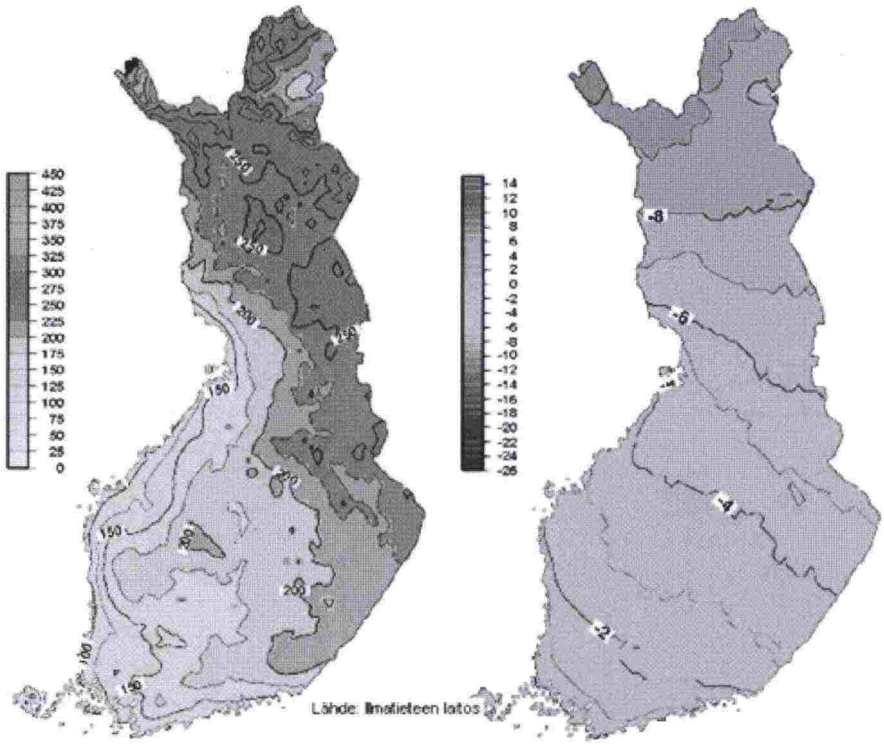


Figure 3. Amount of snowfall (mm) and average temperature during the winter (October–April) (long-term averages, 1971–2000)

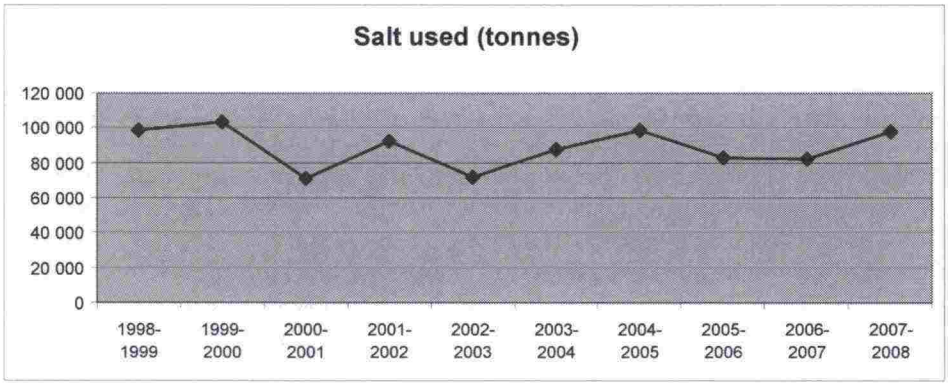


Figure 4. Amounts of salt used during the winter season (does not include salt solutions)

- The annual costs of winter maintenance are approximately EUR 90–100 million.
- About 50% of costs concern highways and main roads, and the other 50% concern regional and connecting roads.
- Snow removal and the smoothing of surfaces accounts for an average of 65% of the costs, while antiskid treatment accounts for about 35%. There is wide variation between the figures in different parts of the country and different sections the road network.
- In 2008, winter maintenance will be implemented through 82 regional contracts, with the length of road in each contract varying from 459 to 2,368 kilometres.

TRAFFIC SAFETY DURING THE WINTER SEASON

During the early 1990s, the risk of a road casualty was significantly higher during the winter season than during the summer season. When the winter speed limits became established and winter maintenance improved, the risk of a fatal road casualty during the winter season fell in the mid-1990s to the same level as the risk during the summer season. In the early 2000s, the risk during the winter season again increased to a higher level than during the summer season. In recent years, following the more extensive use of winter speed limits, and possibly aided by warm winters, the risk of a fatal road casualty during the winter season fell to a lower level than during the summer season. In addition, the increase in automatic speed monitoring may have had an impact on the fact that more drivers observe the lower speed limits during the winter season than before. (figure 5)

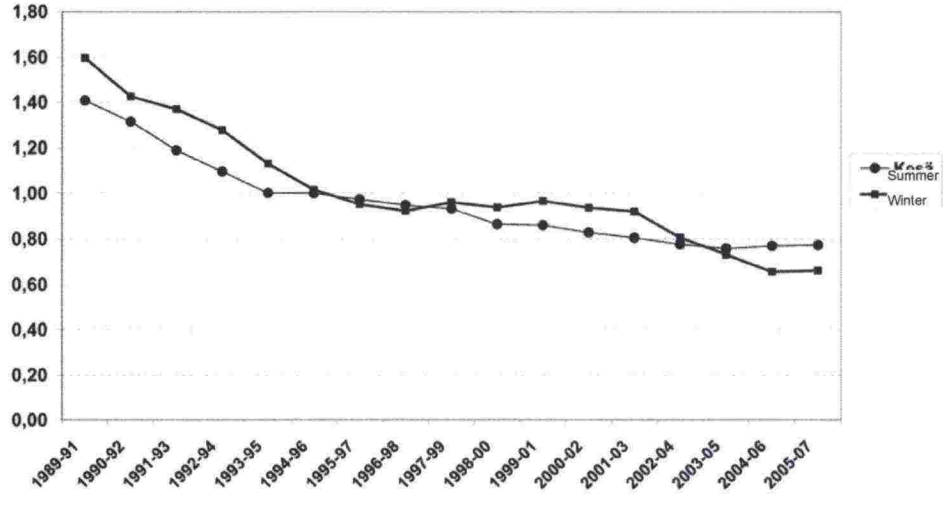


Figure 5. Risk of a road casualty on the highway during the winter season (October–March) and the summer season (April–October) as a three-year moving average during 1989–2007.

The accident profile during the winter season is very different from the summer season. During the winter season, nearly half of traffic deaths are the result of head-on collisions and overtaking accidents, while in the summer season these classes of accidents only account for about a quarter of traffic deaths. During the summer season, there are more fatal individual accidents and animal accidents than in the winter season (figure 6).

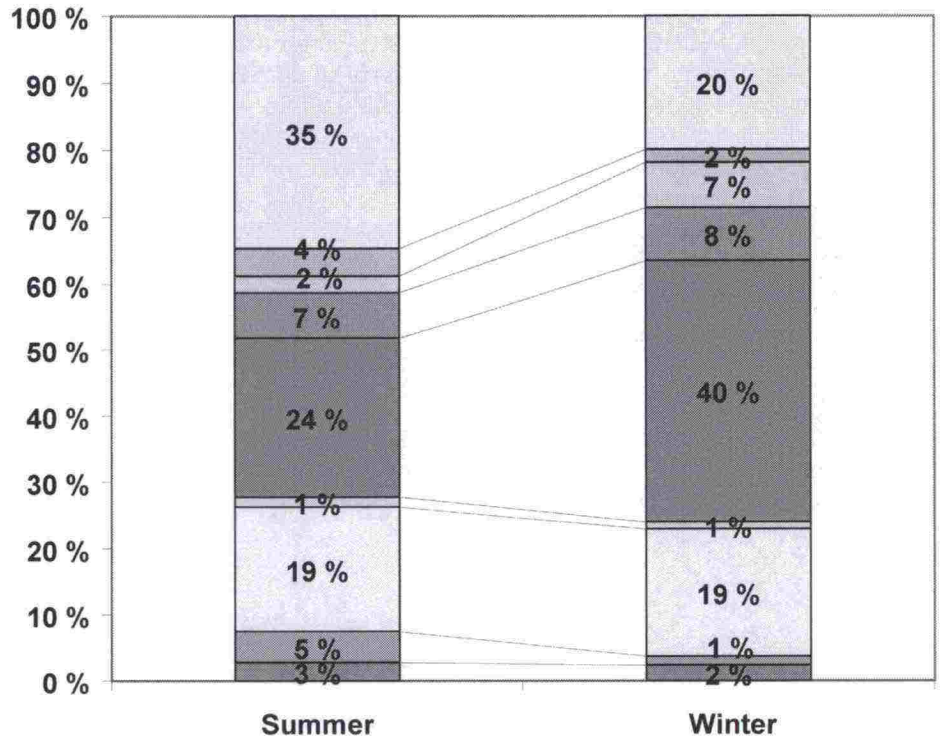


Figure 6. Traffic deaths on highways during the winter and summer seasons, broken down between accident classes 2000–2007.

In examining traffic safety during winter seasons in different winter maintenance classes, it is observed that the risk decreases (i.e., there are fewer accidents causing bodily injury per kilometre driven) as the maintenance class rises (figure 7). Nevertheless, the road environment has a greater impact on this than winter maintenance, as Is maintenance class highways in which opposing lanes are separated are also safer during the summer season, for example.

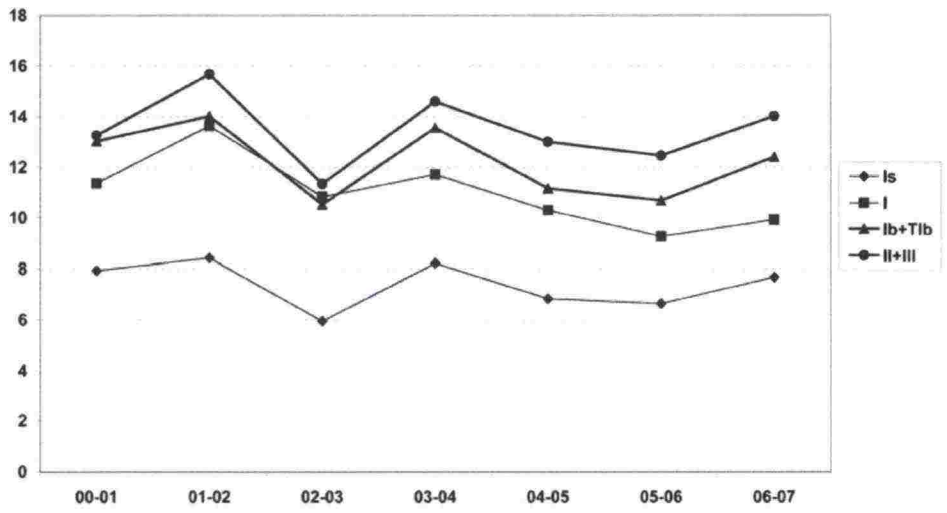


Figure 7. Risk of an accident causing bodily injury (number of accidents per 100 million vehicle kilometres) on highways, broken down by winter maintenance class 2000–2007.

When we examine the number of accidents in relation to the length of the road, i.e. the density of accidents, the order between winter maintenance classes is reversed. Almost without exception, the density of accidents is highest in the locations with the most traffic, i.e. in the highest winter maintenance classes (figure 8). Because the costs of winter maintenance are proportional to the length of the serviced road, on roads with high volumes of traffic it is possible to have an effect on a greater number of accidents with the same winter maintenance expenditure than on low-traffic roads. It would be worthwhile to invest the most in winter maintenance in the areas with the largest traffic volumes and highest accident densities.

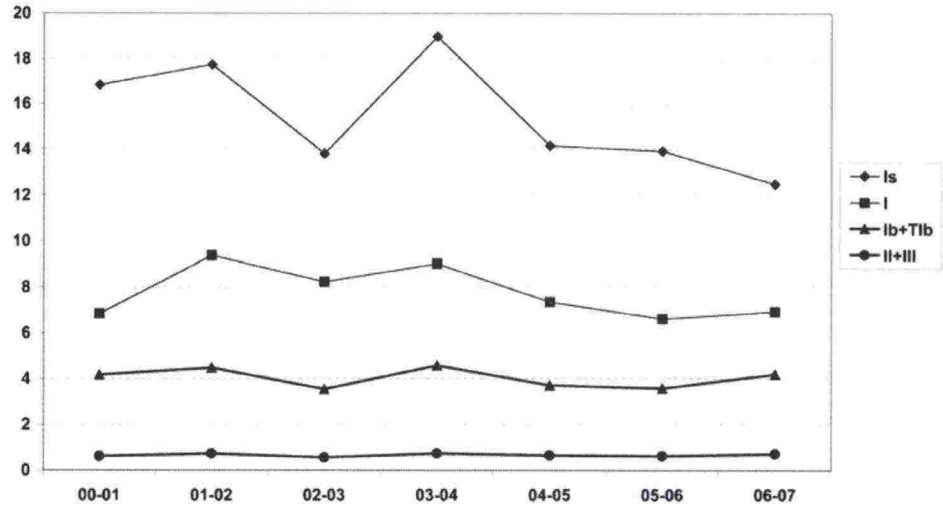
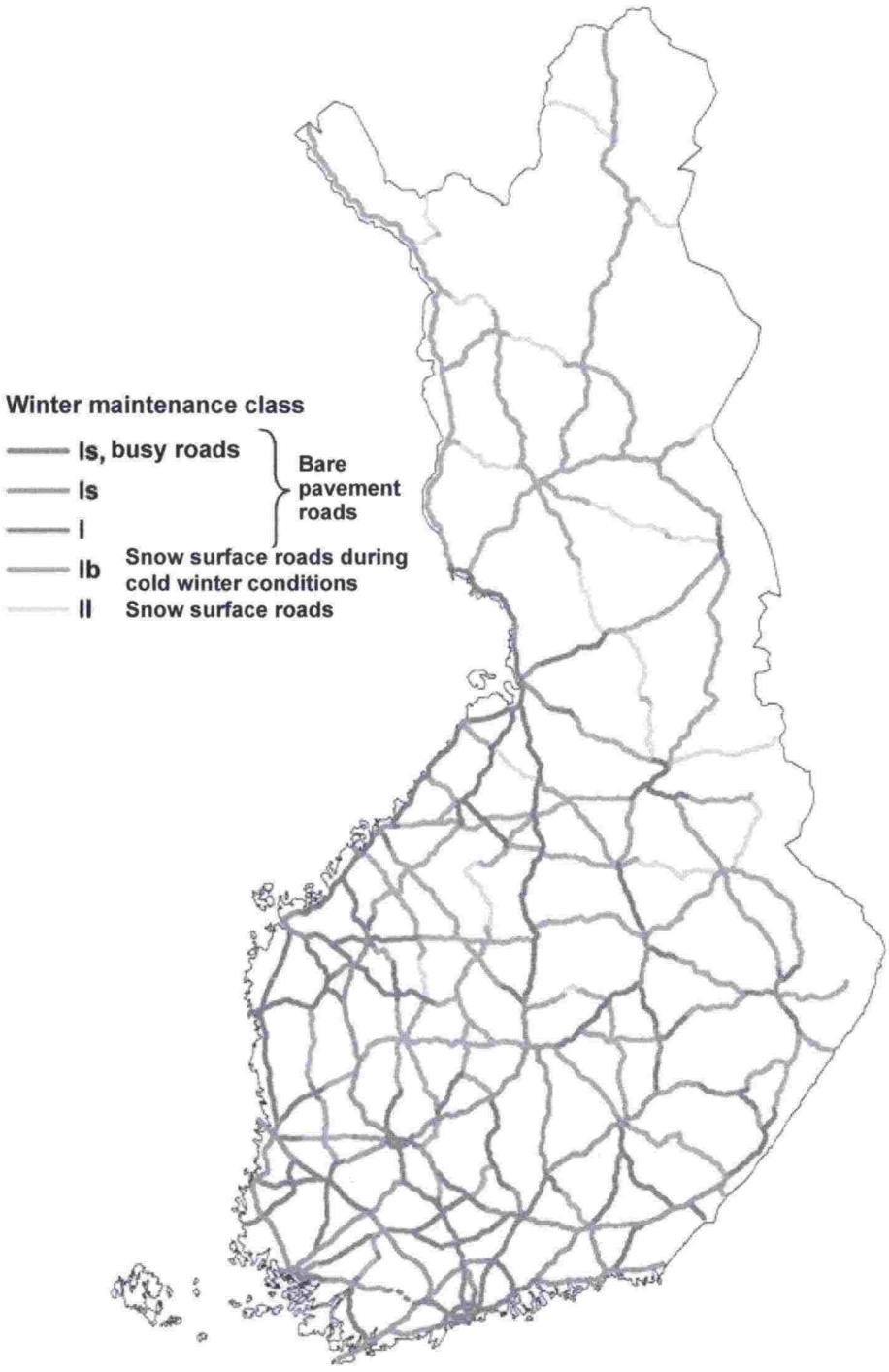


Figure 8. Density of accidents causing bodily injury (number of accidents per 100 kilometres of road) on highways, broken down by winter maintenance class 2000-2007.

WINTER MAINTENANCE CLASSIFICATION OF HIGHWAYS AND MAIN ROADS 1.10.2009



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